DOCUMENT RESUME

ED 480 011 CE 085 334

AUTHOR	Marr, Beth
TITLE	Connecting Students, Sense and Symbols: A Workshop of Practical Activities from Personal Experience, and Informed by Research.
PUB DATE	2001-00-00
NOTE	5p.; In: Schmitt, M. J. and K. Safford-Ramus (Comps.) (2001). Adults Learning Mathematics-7: A Conversation Between Researchers and Practitioners. Proceedings of ALM-7, the International Conference of Adults Learning Mathematics (7th, Medford, MA, July 6-8, 2000) p. 216-219. The conference was hosted by the National Center for the Study of Adult Learning and Literacy (NCSALL) at Harvard University in conjunction with the Tufts University Department of Education and the NCTM-affiliated Adult Numeracy Network.
AVAILABLE FROM	Peppercorn Press, PO Box 693, Snow Camp, NC 27349 (Papers not sold individually, for complete volume: ISBN 1-928836-10-0, $25).
PUB TYPE	Opinion Papers (120) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Adult Basic Education; Adult Educators; *Adult Students; *Classroom Communication; Classroom Techniques; Discovery Learning; *Group Activities; *Group Dynamics; *Individual Activities; Learning Activities; *Mathematics Education; Peer Relationship; Small Group Instruction; Student Centered Curriculum; Student Empowerment; Student Role; Symbols (Mathematics); Teacher Student Relationship; Teaching Methods; Theory Practice Relationship
IDENTIFIERS	Paired Students

ABSTRACT

This paper recounts observations of differences in the interactions of adult students when they are engaged in traditional worksheet tasks in contrast to small group activities and summarizes recent research on the benefits of group work in adult mathematics learning. It offers a selection of group and pair activities designed to foster discussion, encourage visualization and estimation, and facilitate a sense of mathematical meaning beyond formulae and symbol manipulation. (The asymmetry of power and knowledge is less defined in group and pair tasks than in worksheet situations because in the latter situations interactions result in explanatory speech, while in the former they result in exploratory speech. In addition to collaborative structures changing the quality of student interactions, they also expand the range of interactive roles with students spontaneously taking on roles that both increase their means of actively contributing to discussions and signal their participation. In adult classes, educators often focus on the individual needs of students that can be met with traditional worksheet tasks, but small group activities fulfill social needs that can establish cultural touchstones and position students in roles of equality. By connecting sense and symbols, group and pair activities can encourage students to make meaningful connections that strengthen and broaden their understanding of mathematics.) The document includes 14 references.

Reproductions supplied by EDRS are the best that can be made
from the original document.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
B. Marr
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

ED 480 011

CE 085 334

Connecting Students, Sense, and Symbols: A Workshop of Practical Activities From Personal Experience, and Informed by Research

Beth Marr
RMIT University, Australia

Connecting Students

A great deal has been said about the benefits of group work in mathematics learning. Indeed, I have found it a wonderful way to conduct major sections of all my adult classes, both in basic education and pre-service teacher education. In my own classrooms, and in those I have observed through research, I have found many positive benefits from students working together on a variety of structured group problems. The comments which follow are drawn from recent research (Marr, 2000, see elsewhere in this volume) in which I observed the differences in student interactions when engaged in traditional worksheet tasks, in contrast to small group activities.

Collaborative Structures Change Quality of Student Interactions

I found that explicit group and pair structures tended to change the quality of students' interaction and collaboration from that which occurred when using worksheets. In traditional interactions resulting from worksheets, one student tended to wait until another had worked out an answer alone before requesting help, and then was likely to receive more fully thought out opinions or procedures, "explanatory speech" (Barnes, 1976). It seemed that collaborative structures encouraged students to share thoughts whilst they were still in the formative stages, "exploratory speech" (Barnes, 1976). This exploratory interaction style put the students on a more equal footing in the early stages of engagement with the task, and tended to change the power dynamics. Evidence of "intersubjective" meaning making (Cobb, 1995) or jointly constructed knowledge (Mercer, 1995) was found in excerpts of students' dialogue. For example, interrogative phrases like "that's what you are saying aren't you?" and "is that what you mean?" indicated that the students were clarifying ideas together and building on each other's explanations. Thus it seemed that the asymmetry of power and knowledge was less defined in group and pair tasks than it was in worksheet situations.

Group Collaboration Expands the Range of Interactive Roles

Group collaboration also tended to expand the range of interactive roles students could take on, thereby increasing their means of actively contributing to discussion and signaling their participation. Some took on social roles within the group: explaining the task to latecomers, keeping the group on track, and asking clarifying questions. Others contributed differing types of knowledge. For example, some contributed knowledge drawn from their use of measurement at home, social discourses (Lee, 1994), exemplified by contributions about cups and cubic metres of soil. Others contributed from their knowledge of the mathematical discourses such as fractions and areas. These roles were not assigned, or even discussed, in this classroom, but occurred spontaneously during the group work. Their existence was noted only after analysing tapes and videos of the group interaction. The emergence of these different roles within the task interaction allowed more students to contribute positively to the group and to learn from others whilst doing so.

The notion of contributing and learning as a peripheral participant (Rogoff, 1995) was illustrated by one student who took on a social facilitation role in the small group. This role allowed her a way to participate actively although she had little confidence in her knowledge of the topic. In doing so she signalled her involvement and learned from the discussion of the other group members. These multiple roles in the small groups appeared to allow for diversity of participation, in contrast to the situation of "primary knowers" and those who asked for their help (Veel, 1999), which predominated in worksheet situations.

Catering for Individuals Versus Social Needs

However, adult classes are often made up of students with a wide range of needs, and levels of knowledge. This tends to mean that educators are swayed towards providing individual work that satisfies the expressed needs of each student, and deciding that working in groups will not be appropriate. Although I agree that catering for

BEST COPY AVAILABLE

each individual student is essential in most adult situations, I also think it is important to consider making connections within the groups as well.

I believe that for many adult students there is an unspoken social need that is integral to their return to study. Leaving the isolation of the home and mixing with others seems an important part of the new learning experience. In my experience the need for this aspect of returning to study is especially true of adult women students. If their classes are organised to include some time in which students mix with each other in structured group and/or pair activities then they have opportunities to create the necessary social links. Mixing purposefully with other students allows for the creation of personal connections through sharing information about one another. Beach (1992), referring to this type of interaction between students as "self disclosure about their lives and experiences" (p. 99), asserts that in some circumstances the social bonds created make students more willing to listen to each other's subject related ideas. So not only does such conversation create possibilities of social communication and friendship but it also creates links which facilitate students helping each other with the subject.

My own teaching experiences with adults indicate that group activities, which foster discussion through hands-on activity, can change students' attitude to the subject and make the classroom atmosphere lively, cooperative, and enjoyable. In the classroom research I found that not only did sharing the materials bring students together to solve problems, the materials were often a trigger for other forms of communication. For example, sharing memories of childhood games was provoked by the string used for area and perimeter investigations, and the plumbing pipes fitted together to model a cubic metre facilitated recollections of building cubby-houses and many jokes about children. These connections with childhood pursuits could be seen as negative distractions if they continued for too long. However, this was not usually the case, and it is also possible to view these off-task moments from the perspective suggested by Baynham (1996). Baynham refers to "identity work": interchanges between the adult class members and the teacher that enabled them to see themselves in equal adult roles outside of the classroom situation. Baynham sees this identity work as an important aspect of students maintaining their self-respect and adult status in the potentially disempowering classroom situation. Similarly, Benn (1999) refers to establishing "cultural touchstones," a range of common interests between teacher and students, which are referred to in classroom communication and act to bridge cultural and status gaps. Thus sharing stories of common childhood experiences or "positioning" the students in the parent role (Walkerdine, 1988) can be seen as a valuable dimension of the class. In this case it was facilitated by hands-on materials.

Household containers and bottles used in several activities also seemed to provoke a sharing that "positioned" the students in the adult world. For example, alcohol bottles, ice cream, and yoghurt containers encouraged exchanges about drinking habits and food preferences. These off task exchanges, triggered by the introduction of real world artefacts into the classroom, allowed for the personal disclosure, identity work, and creation of cultural touchstones described above.

Connecting Sense and Symbols

The examples discussed illustrate valuable connections between people, the teacher and students, that can be facilitated by group and pair work using reality based situations and artefacts. If, in addition, the group and pair activities are selected to encourage students to make meaningful connections between their lives, mental images, and the symbols and formulae of mathematics, then the time is doubly well spent.

In the research classroom real-life materials such as the domestic containers seemed to contribute positively to the mathematical dimensions of the tasks for these adults. The data revealed the domestic artefacts acting as "footholds" from familiar discourses into the mathematical activity (Boomer, 1986). Or, put another way, the students could "position" themselves in a field where their prior knowledge or conceptual frameworks were connected with the current mathematical meanings. For example, their practical knowledge of familiar containers assisted estimating unfamiliar volumes. The deceptive visual impact of tall thin cylinders was "noticed" because it resonated with students' adult consumer awareness. This not only allowed for discussion of packaging strategies, but also for formulating hypotheses about shape and volume relationships. It also created

continuous opportunity to develop students' mathematical language. These were positive illustrations of linking "spontaneous" and "scientific" concepts (Bruner, 1984; Vygotsky, 1962).

Yet another unexpected effect of using the familiar domestic and other hands-on materials was the triggering of memories from one session to the other which seemed to be created through the visual impact of the physical artefacts. The lasting memories appeared stronger than any that the words and diagrams traditionally used on worksheets had provoked, since students' speech in later tasks contained many direct references back to prior visual memories. Their hold on the mathematical ideas and relationships seemed to be strengthened by association with previous instances in which they had arisen. For example, the food and drink containers used in the estimation task became synonymous with cylinders and were visualised by the students in later tasks. The string used to model "fencing," or perimeter, was also referred to in later situations.

Students who made connections between the tasks seemed to be showing evidence of greater "ownership" of the relationships and the language. These observations agree with suggestions by Brown, Collins, and Duguid (1989) that exposure to conceptual language in a variety of different situations strengthens and broadens students' understanding of mathematical terms.

This workshop offered a selection of group and pair activities designed to foster discussion, encourage visualisation and estimation, and facilitate a sense of mathematical meaning beyond formulae and symbol manipulation.

References

Barnes, D. (1976). *From communication to curriculum*. London: Penguin.

Baynham, M. (1996). Humour as an interpersonal resource in adult numeracy classes. *Language and Education, 10*, 187-200.

Beach, R. (1992). Adopting multiple stances in literacy research. In R. Beach, J. Green, M. Kamil., & T. Shanahan (Eds.), *Multidisciplinary perspectives on literacy research*. Urbana, IL: National Council of Teachers of English.

Benn, R. (1999). Mathematics, class and lifelong learning. In *Mathematics as part of lifelong learning* (Proceedings of the 5th International Conference of Adults Learning Mathematics—A Research Forum). London: Goldsmiths College, University of London.

Boomer, G. (1986). From catechism to communication: Language, learning, and mathematics. *Australian Mathematics Teacher, 42*, 2-7. (Reprinted in *Inservice Program for ALBE Personnel—Module 5*, Canberra: National Staff Development Committee—Commonwealth of Australia)

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Bruner, J. (1985). Vygotsky: A historical and conceptual perspective. In J. V. Wertsch (Ed.), *Culture, communication and cognition. Vygotskian perspectives*. New York: Cambridge University Press.

Cobb, P. (1995). Mathematical learning and small-group interaction: Four case studies. In P. Cobb & H. Bauersfeld (Eds.), *The emergence of mathematical meaning: Interaction in classroom cultures*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Lee, A. (1994). Discourse, mathematics and numeracy teaching. In D. Riordan & D. Tout (Eds.), *Numeracy in focus*. Melbourne: Adult Literacy Information Office (NSW) and Adult Basic Education Resource Office (Vic).

Marr, B. (2000). *Enhancing students' communicative competence in the adult mathematics classroom*. (Thesis in progress)

Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon, UK: Multilingual Matters.

Rogoff, B. (1995). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In J. V. Wertsch, P. del Rio, & A. Alvarez (Eds.), *Sociocultural studies of mind*. New York: Cambridge University Press.

Veel, R. (1999). Language, knowledge and authority in school mathematics. In F. Christie (Ed.), *Pedagogy and the shaping of consciousness*. London: Cassell.
Walkerdine, V. (1988). *The mastery of reason*. London: Routledge.

CE045334

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Connecting students, sense and symbols
~~How~~

Author(s): Beth Marr

Corporate Source: Faculty of Education, Language + Community Service
RMIT University Melbourne
ADULTS LEARNING MATHEMATICS

Publication Date: 2001

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1

☑

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A

☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B

☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature:	Printed Name/Position/Title: MS BETH MARR
Organization/Address: RMIT University PO Box 71 Bundoora, Vic 3083 Australia	Telephone: 61 3 9925 7822 / FAX: 61 3 9925 7815
	E-Mail Address: beth.marr@rmit.edu.au / Date: 13/9/2000

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, *or*, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
4483-A Forbes Boulevard
Lanham, Maryland 20706

Telephone: 301-552-4200
Toll Free: 800-799-3742
FAX: 301-552-4700
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com